Though M. Cels has devoted so large a part of his work to the logical methods of anthropology, he tells us little or nothing of the immense advance that has been made in recent years in anthropometrics. No science makes much progress until precise measurement is applied to the characters the distribution and correlations of which are to be ascertained. Measurement has been applied to the body of man for more than fifty years, but only within the last few years has a statistical method been devised which enables us to give the true interpretation of the vast amount of anthropometric statistics that has been accumulated. But the work of Galton and Karl Pearson receives no notice from M. Cels in his work on the science of man and anthropological method; we are referred rather to the works, published fifty or more years ago, of Cuvier, Krause, and Saint-Hilaire, whose ideas on co-relation were mere shadows of the precise knowledge we now possess.

As a highly abstract and suggestive exposition of the nature and scope of anthropology, the book deserves a place in the library of the anthropologist.

J. GRAY.

PROGRESS IN THE CHEMISTRY OF FATS.

Chemical Technology and Analysis of Oils, Fats, and Waxes. By Dr. J. Lewkowitsch, M.A., F.I.C. Third edition, re-written and enlarged. Two vols. Pp. xxviii + 1152. (London: Macmillan and Co., Ltd., 1904.) Price 36*s.* net.

IN this, the third edition of Dr. Lewkowitsch's well known work, there is naturally much that was not included in the former issues. And since the second edition was itself a somewhat bulky tome of more than eight hundred pages, the author has wisely divided the present work into two volumes, corresponding broadly to the analytical and technological branches into which his subject resolves itself.

Briefly, the first volume deals with general principles, the second with individual products. In the earlier chapters there is a discussion of the theory of saponification, and a description of the glycerides, esters, alcohols, and acids which form the proximate constituents of oils, fats, and waxes; the rest of the first volume is mainly devoted to an account of the chief physical and chemical methods now employed in the examination of these substances. In the second volume, after a short generalised description of their commercial methods of preparation, the individual oils, fats, and waxes are dealt with. Under each article are given its source, characteristic features, physical and chemical constants, and such miscellaneous information as the technical uses of the product and the nature of its probable adulterants. Finally, the last two chapters embody an account of modern manufacturing processes employed in the various industries —soap, candle, rubber, glycerol, and so on—for which the raw materials are furnished by oils and fats.

To specialists, the foregoing summary will show the present arrangement of what is now the standard English book of reference on the subject. To chemists who have not followed the progress of the chemistry of the glycerides very closely it may be useful to indicate a few of the more recent developments which, among many others, Dr. Lewkowitsch has described or referred to in the book under review.

Looking back over the work of the last few years, what strikes one as being the most notable advance in the chemistry of fats is the recognition of mixed glycerides as frequent if not normal constituents of fats and oils. Since the days of Chevreul, until quite recently, these latter bodies have been almost universally regarded as mixtures of simple triglycerides —usually trioleïn, tripalmitin, and tristearin. True, evidence was adduced more than a quarter of a century ago, on the one hand by Bell and Lewin, and on the other by Blyth and Robertson, which pointed to the fact that butter-fat contained a mixed glyceride, oleopalmitobutyrin. But, probably owing to the difficulty of isolating and definitely proving the identity of such compounds, the observation long remained almost unnoticed. During the last few years, however, the mixed glyceride oleodistearin has been obtained by Heise from kokum butter, stearopalmitin by Hansen from tallow, oleopalmitostearin and oleodipalmitin by Klimont from cocoa-butter, and daturodistearin by Kreis and Hafner from lard. This does not exhaust the list; and, indeed, the probability is that on further investigation mixed triglycerides will be found in most oils and fats. Several have also been synthesised, chiefly by Guth; thus two isomers of stearodipalmitin have been prepared, the α variety from α-monostearin and palmitic acid, and the β form from α-dipalmitin and stearic acid.

Another point of interest is the frequent, and perhaps general, occurrence of fat-splitting enzymes such as steapsin in both vegetable and animal oils and fats. The author is strongly in favour of the view that the rancidity of fats is due initially to hydrolysis of the glycerides by these ferments. To this, however, one possible objection suggests itself. Enzymes are usually destroyed at moderately high temperatures—*e.g.* maltase at 80°. Is there any evidence to show that lard or tallow prepared at steam-heat, or any fat specially raised to a temperature of, say, 95° to 100°, does not turn rancid? If it does not, so much the better for the enzyme theory of rancidity. If it does, one would still like to have other evidence that the enzymes present are capable of withstanding these higher temperatures.

As regards the analytical chemistry of fats, the most important among recent advances is undoubtedly Hehner and Mitchell's method of determining stearic acid. It is not an ideal process, and shows at least one anomaly; but it does place in the chemist's hands a valuable and long-wanted means of estimating, with reasonable accuracy and expedition, the proportion of one of the most frequent constituents of natural glycerides. To the same investigators, following Hazura, is also due the working out of what promises to be a very useful aid to the study of unsaturated glycerides, namely, the quantitative determination of their hexabromide derivatives. Of new methods having an immediate value to the practising analyst there may be mentioned Bömer's phytosterol test for vegetable oils, and Polenske's process for detecting

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cocoa-nut oil in butter. No reference, however, is made to the Müntz and Coudon method of estimating the latter adulterant.

These are but a few out of many points of interest which one notes on looking through the book. A number of new illustrations appear, including some, which might be improved upon, of lard, cholesterol, and phytosterol crystals. There are plenty of references to original sources, and the information generally is brought well up to date, several papers issued in the present year being laid under contribution.

"Adulteration," says Dr. Lewkowitsch, "has almost become a fine art." No doubt it has; and in the silent, ceaseless struggle between the cunning of the adulterator and the skill of the analyst such works as the present play an important part. They are very helpful to the former individual, certainly. But to the latter they are invaluable.

C. SIMMONDS.

STOKES'S MATHEMATICAL AND PHYSICAL PAPERS.

Mathematical and Physical Papers. By the late Sir G. G. Stokes. Vol. iv. Pp. viii+378. (Cambridge: The University Press.) Price 15*s*.

IT was on all grounds fitting that the continuation of this reprint should be entrusted to Prof. Larmor. The energy with which he has addressed himself to the work is shown by the fact that, although it is little more than a year since the death of his great predecessor, we already have a new volume in our hands, containing, in addition to the text, some valuable annotations and a selection from some very interesting correspondence.

The papers here reproduced range in date from 1853 to 1876; they are about forty in number, and, as a rule, are shorter and more restricted to special points than is the case in the previous volumes. There are, however, some notable exceptions. From the mathematical point of view the most considerable is the memoir "On the Communication of Vibration from a Vibrating Body to a Surrounding Gas." Perhaps the highest testimony to the excellence of this investigation is that Lord Rayleigh, who usually transforms and illuminates what he touches, in this case found, as he tells us, no better course open to him than to print page after page *verbatim* in his "Theory of Sound." The memoir is important, historically, not solely for the interest of the particular phenomenon which it explains, but as leading the way for a whole series of investigations in acoustics, optics, and electricity, in which we have to deal with waves diverging from point- or line-sources. Especially characteristic of the author is the labour expended with a view of reducing the results to a definite numerical form. From another point of view the paper may be regarded as forming one of the long series (some other members of which fall in the present volume) in which Stokes attacked the difficulties of the Bessel functions; other methods of dealing with these have since been devised, but it is mainly through his labours that these functions have become real and intelligible instruments of the mathematical physicist, instead of merely abstract analytical expressions.

We also find in this volume the classical "Report on Double Refraction," presented to the British Association in 1862. This has entered into so many discussions, that it is unnecessary to refer to it in detail. Although elastic theories of light no longer excite the same interest, the report is still worthy of careful study, not only on intrinsic grounds, but also as a masterpiece of criticism, and as an embodiment of the clear and judicial mind of its author.

Among experimental investigations, we may note the very important paper "On the Long Spectrum of the Electric Light," and the verification of Huyghens's law of refraction in uniaxal crystals, which has served as a touchstone of optical theories.

A short, but extremely acute, paper "On the Effect of Wind on the Intensity of Sound," read before the British Association in 1857, was unfortunately unnoticed and forgotten until the explanation was rediscovered, and extended so as to include the effect of variations of temperature, by Osborne Reynolds in 1874.

It will not be supposed that the numerous other brief memoirs which we are obliged to pass over without special mention are unimportant. To the scientific worker the value of such a collection often resides chiefly in these minor investigations, which are otherwise in danger of being overlooked, as in the instance just referred to.

As has been already mentioned, the editor has appended a few notes, chiefly of a historical character. This delicate task has been exercised with great judgment and restraint. He has also included a most interesting correspondence between Stokes and Thomson on the early history of spectrum analysis. It is clear that long before Kirchhoff's first publication on the question Thomson was in possession of the leading ideas of the subject, and foresaw its wonderful possibilities, and that he had, moreover, publicly expounded these things in his lectures at Glasgow. But whilst he is emphatic that he derived his knowledge from Stokes, the latter is equally positive that his share in the matter was limited to suggestions which he had himself not been able to follow out with the same confidence. The whole correspondence is a lesson of magnanimity on both sides; we feel, as Lord Rayleigh recently expressed it, that the theory of spectrum analysis is practically there, but it would be contrary to the whole spirit of the friendly debate to attempt to analyse further how much of the merit of this prevision belongs to one rather than to the other. One point, however, remains indisputably associated with the name of Stokes, viz. the hypothesis that special absorption of light is due to coincidence, or approximate coincidence, of the period of the light waves with a proper period of a molecule. Hypotheses of this kind have played a great part in recent theories of anomalous dispersion and the like; but there can be no question as to their original source.

The remaining papers are to be included in a fifth volume, together with the biography by Lord Rayleigh recently issued by the Royal Society. We are also

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